

ENGINEERING HERITAGE RECOGNITION PROGRAM

Nomination of SYDNEY TOWER as an Item of Engineering Heritage Interest

Item Name:	Sydney Tower		
Other/Former Names:	AMP Tower; Westfield Tower, Centrepont Tower.		
Locality:	Sydney, Central Business District		
Address:	108 Market Street, Sydney		
Co-ordinates	Lat: -33.870155 Lon: 151.208912		
Current Owner:	Westfield		
Original Owner:	Developer: AMP Society		
Current use:	Observations and communications tower, and restaurant		
Former use:	Observations and communications tower, and restaurant		
Proposed use:	No change		
Item Condition:	Excellent		
Designer:	<i>Architects:</i> Donald Crone & Associates Pty. Ltd. <i>Structural engineers:</i> Wargon Chapman & Associates Pty. Ltd . <i>Wind studies consultant:</i> Prof. B. J . Vickery, University of Western Ontario, Canada <i>Metallurgic consultant:</i> Prof. D. J. Corderoy, University of New South Wales, Sydney		
Builder:	<i>Builder:</i> Concrete Constructions (NSW) Pty. Ltd. <i>Erection consultants:</i> Redpath Dorman Long (Constructions) Ltd., Bedford, England.		
Started:	Tower started 1975	Completed:	1981
History:	<p>The AMP Society's Centrepont project designed to breathe new life into Sydney's retailing heart, always had a tower planned as a physical focus for the people of Sydney.</p> <p>The idea was not new. The Eiffel Tower was a centre of Parisian controversy during its construction for the International Exposition of 1889, but emerged as a profitable enterprise, a major tourist attraction and finally as the signature of the French capital.</p> <p>For Sydney Tower, the path from concept to reality led around the world and through many areas of architecture, engineering and their associated sciences.</p> <p>The architect, Donald Crone, and the structural engineer, Alex Wargon, enlisted the best people in the world in many disciplines to ensure that the tallest building south of the equator would be unique and successful.</p> <p>The Tower is designed to withstand the worst predictable Sydney weather in the next 1000 years and its aerodynamic qualities owe a great deal to the advice of Dr Barry Vickery who is regarded as the leading world authority on the effect of gusting winds on tall structure.</p>		

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Following his advice, and consultation with an international scientific fraternity, the tower was equipped with an unusual hydraulic method of keeping sway in high winds within human comfort levels.

A 165,000 litre water tank is suspended on cables in the turret and sways at the same frequency as the building, but out of phase with it. This contra-movement provides a mechanical damping of wind-induced vibrations.

Fluting on the Tower shaft is also designed to prevent wind vortices forming on the buildings leeward side and causing oscillation.

Cables were added to provide extra stiffness to the slender structure and an Australian consortium was formed to make the cables under a universally-proven Swiss patent.

The builders, Concrete Constructions Pty Ltd, consulted the English firm, Redpath Dorman Long, of Bedford, England. Together, they devised methods of constructing the Tower from pre-made sections assembled on the roof of the 50,800-tonne concrete Centrepont building.

The stem of the tower was made by stacking 46 barrel-shaped steel units on top of each other on the roof.

Each unit was brought to the 74m high workplace in seven segments, welded together and fitted with stairs, lift rails, service pipes and internal partitions before being lifted into position by a special gantry perched on top of the "stack".

The 1920-tonne turret, the golden section now familiar to Sydney people, was assembled around the stem on the roof of the supporting building and lifted hydraulically at a rate of nine metres a week.

Studies in a wind tunnel in Canada helped determine the sequence of adding cables to the structure. Drawing the cables in to form a waist added grace to the appearance of the tower and distributed stress caused by wind thereby giving the structure the stiffness of a conventional building of the same height.

A final stage of construction was the addition of a spire capable of holding telecommunications antennae which took the tower to its full height of 324.8m above harbour level.

Concrete Constructions built the turret to within 5mm of its planned height despite the complexity of the engineering problems it had to overcome in the project.

Opened in September 1981 the building has been described by the President of the Institute of Structural Engineers in Britain as "one of the most exciting building schemes in the world".

In 1994 on the occasion of its 75th Anniversary, The Institution of Engineers, Australia presented the tower with a plaque reading:

Sydney Tower

The tallest structure in the southern hemisphere is 325 metres high and was opened in September 1981. Its design and construction for AMP society was conceived and executed by Australians, Architects (Donald Crone and Associates), Engineers (Wargon Chapman and Associates) and Contractors (Concrete Constructions) applying advanced technology and techniques. The entire structure was manufactured in Australia using (with some minor exceptions) Australian-made materials. The nine-storey turret which serves as a tourist-telecommunications facility is supported on the shaft and is stabilised by two mass dampers tuned to prevent undesirable movement due to wind forces. The damping system was pioneered in Australia and has since been used in a number of buildings around

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	<p>the world. The tower was instrumental in consolidating the retail heart of the city and it symbolises the progressive spirit of Sydney.</p> <p style="text-align: center;">Dedicated by the Institution of Engineers, Australia On the occasion of its 75th anniversary 1994 AMP</p>
Description:	<p>The tower comprises a steel shaft surmounted by a turret and spire for telecommunications and navigation purposes; it is 309 metres from the bottom of the tower to the tip of the spire.</p> <p>The shaft is 6.8 m in diameter and was fabricated from 350 MPa weathering steel, which was the first time the material was used extensively in Australia. It is guyed by two families of cables, one extending right to left and the other left to right, to achieve greater torsional rigidity. There are 56 cables each comprising 235, 7 mm dia. wires, bunched together.</p> <p>The turret has a capacity of 960 persons and contains two levels of restaurants, an Observation Deck, two telecommunication transmission levels and three plant levels.</p> <p>A 165,000 litre water tank is suspended on cables in the turret and sways at the same frequency as the building, but out of phase with it. This contra-movement provides a mechanical damping of wind-induced vibrations.</p> <p>Within the shaft there are three double deck lifts that provide access to the Observation Deck and restaurants; a set of pressurised stairs that allow patrons direct access to street level in case of an emergency; and service pipes and cabling.</p>
Engineer:	<p>Alexander Wargon MSc, CEng, FICE, FIEng (Aust), MNZIE, FASCE was born in Warsaw, Poland in 1926. He escaped the holocaust, studied in Israel and Harvard and arrived in Sydney in 1958. He joined consulting engineers Rankine & Hill and later formed Wargon Chapman & Associates Pty. Ltd.</p> <p>The best-known of his over 4000 projects were Sydney Tower and the Sydney Harbour Tunnel of which he was one of the instigators, and joined with Transfield and Kumagai Gumi in its design.</p> <p>Alexander Wargon died in 2010.</p>
Engineering Significance:	<p>Sydney Tower:</p> <ul style="list-style-type: none"> • Is associated with its designer, the eminent engineer Alexander Wargon. Wargon was also one of the instigators of the Sydney Harbour Tunnel and joined with Transfield and Kumagai Gumi in its design. • Demonstrates creative and technical achievement in both its design and construction. Its design involved sophisticated structural design techniques, wind studies and metallurgical analysis. And its construction involved the application of advanced technology and techniques. • When constructed, exhibited rarity - the shaft of the tower was fabricated from 350 Mpa weathering steel, which was the first time the material had been used extensively in Australia. And the damping system involving suspension of a 165,000 litre water tank in the turret to control wind-induced vibrations, was pioneered in Australia, and was subsequently used in a number of buildings around the world. • Has a strong social association with the City of Sydney - it was instrumental in consolidating the retail heart of the city and it symbolises the city's progressive spirit .

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Webpage Summary:	<p>At 325 metres high Sydney Tower is the tallest structure in the southern hemisphere; it was opened in September 1981. Its design and construction for AMP society was conceived and executed by Australian architects (Donald Crone and Associates), engineers (Wargon Chapman and Associates) and contractors (Concrete Constructions), applying advanced technology and techniques. The entire structure was manufactured in Australia using (with some minor exceptions) Australian-made materials.</p> <p>The nine-storey turret which serves as a tourist and telecommunications facility is supported on the shaft and is stabilised by a mass damper tuned to prevent undesirable movement due to wind forces. The damping system was pioneered in Australia and has since been used in a number of buildings around the world.</p> <p>The tower was instrumental in consolidating the retail heart of the city and it symbolises the progressive spirit of Sydney.</p>		
Engineering Theme:	Civics and Buildings: Commercial		
Heritage Listing:	Nil		
References/Sources:	<p>Sydney Tower: brochure for plaque award ceremony, 1994.</p> <p>Wargon, Alexander: <i>Design and Construction of Sydney Tower</i>, The Structural Engineer/Volume 61A/No. 9/September 1983.</p> <p>https://www.sydneytowereye.com.au/explore/explre/about-sydney-tower/</p> <p>Gonski, David: Obituary, Alexander Wargon, The Sydney Morning Herald 20 November 2010.</p>		
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EHA Branch:	Sydney	Nomination Date:	16 November 2023



Sydney Tower through sculpture at Art Gallery NSW. *Michael Clarke*

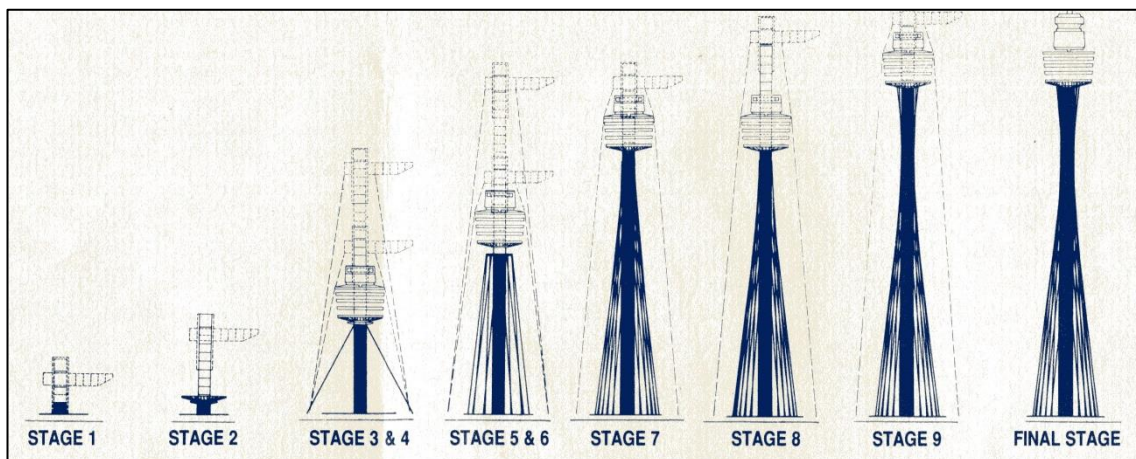


Sydney Tower from Hyde Park. *Michael Clarke*

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Sydney Tower from Market Street.
Michael Clarke



Sydney Tower erection procedure. *Brochure for plaque award ceremony.*